

Air and Space Natural Environment Modeling and Simulation Executive Agent



**INTEGRATED NATURAL
ENVIRONMENT
AUTHORITATIVE
REPRESENTATION
PROCESS (INEARP)**

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ESG Development Lead**

| Report Documentation Page | | | Form Approved OMB No. 0704-0188 | |
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Motivation



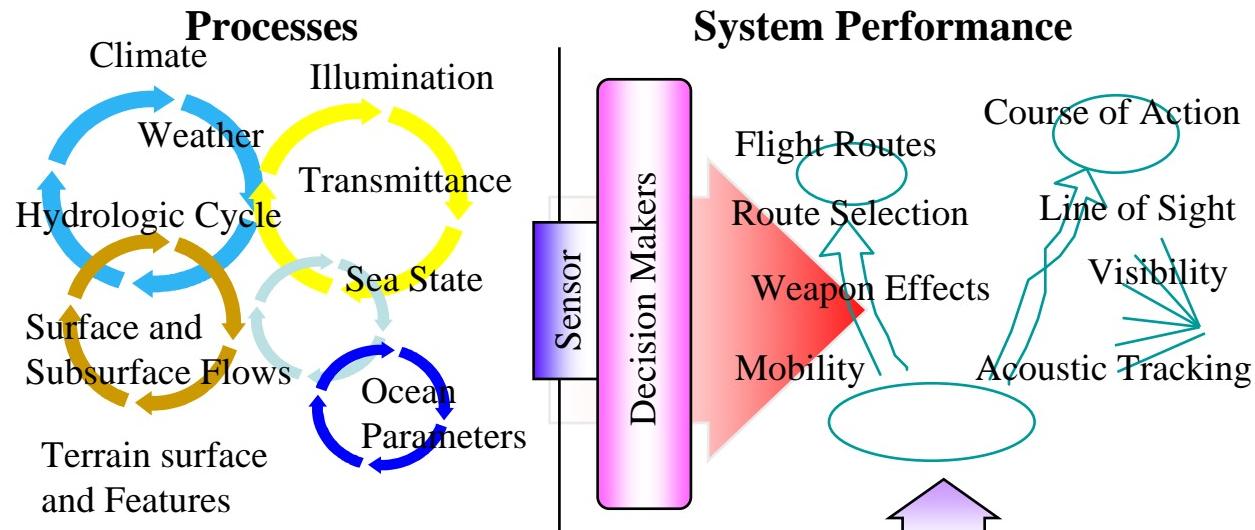
- In many cases, a simulation's fidelity depends on interaction with the environment
 - Aircraft tactics based on clouds and visibility
 - Naval tactics based on acoustic performance
 - Troop movement rate determined by ground wetness
- Environment must be realistic and consistent
 - Should see ground get wet if it rains
 - Should see ocean response to high winds



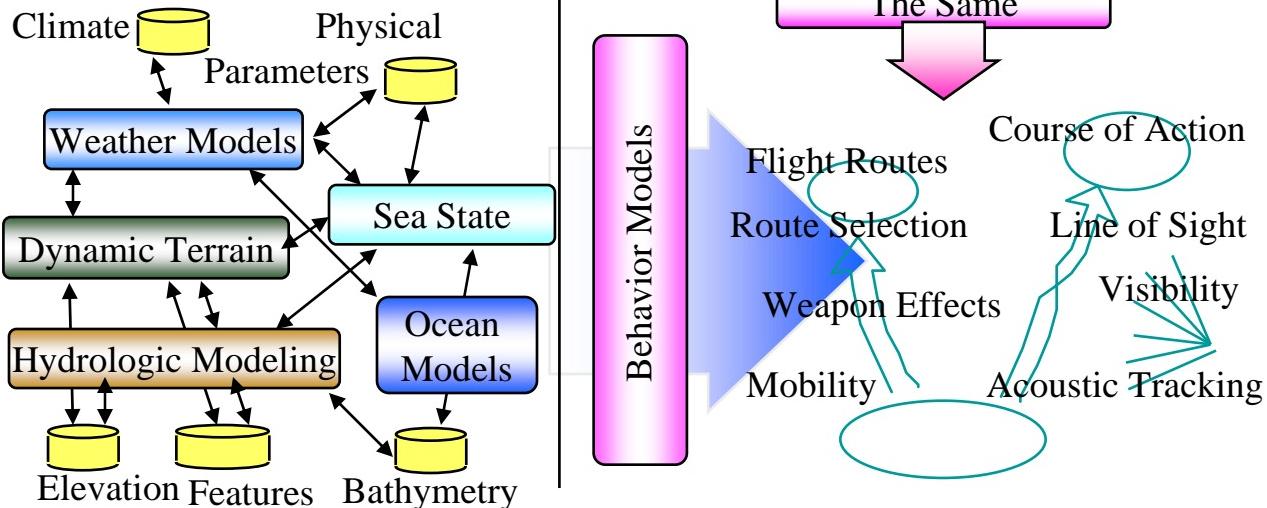


Integrated Natural Environment

Natural



Synthetic



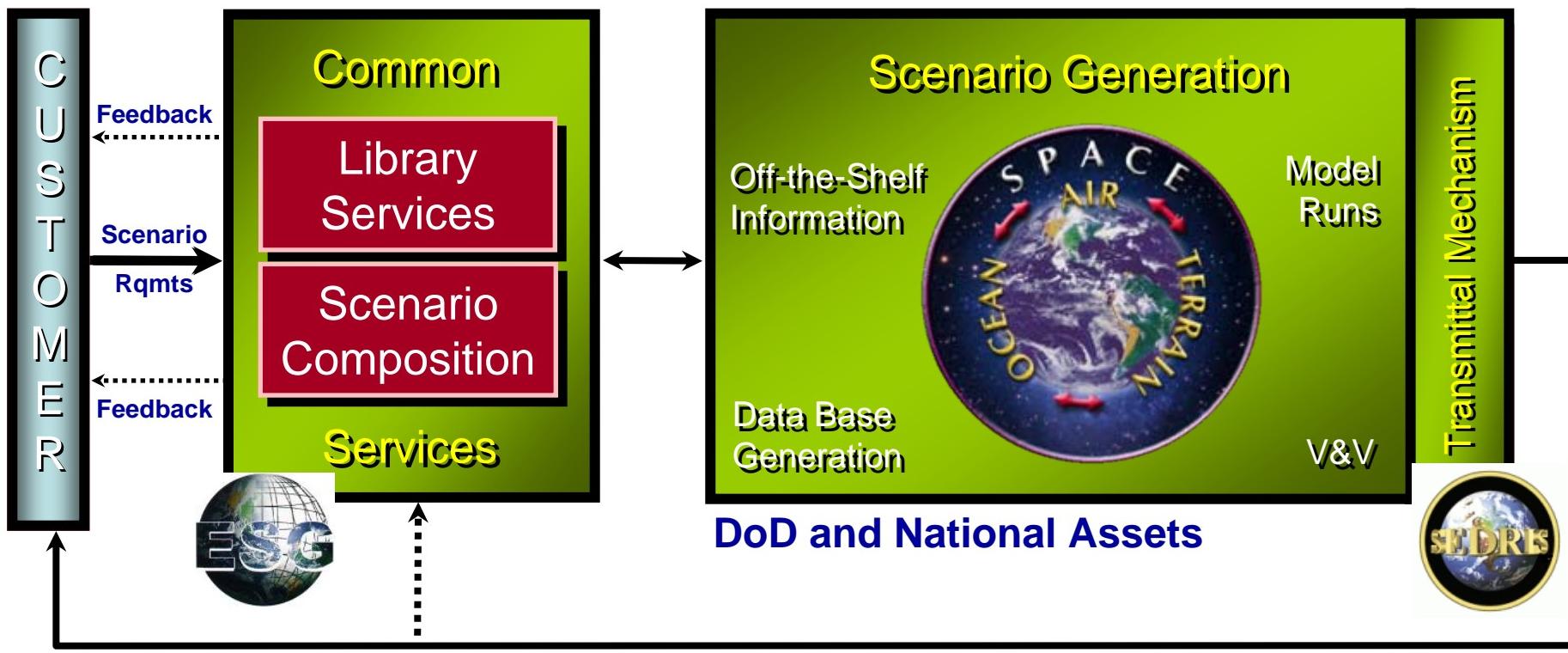


INEARP: A Strategy and Process Model for Environment Support M&S

Integrated Natural Environment
Authoritative Representation Process (INEARP)

The Challenge

Create a physically consistent, cross-domain authoritative “ground truth” environment representation that meets user requirements.

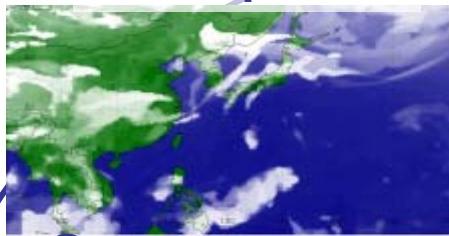




Environmental Scenario Generator

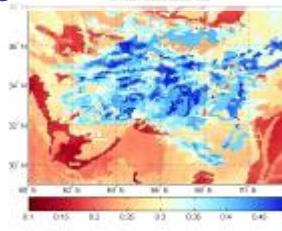
Key Enabling Technology for the INEARP

Atmosphere

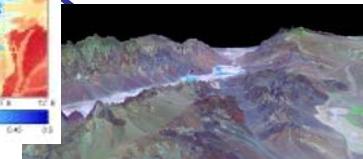


coupled

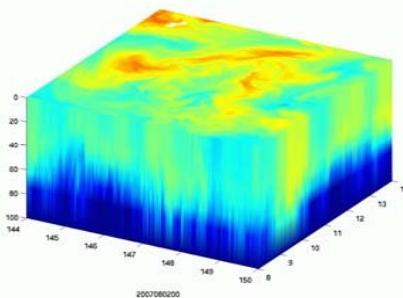
Dynamic Terrain



Terrain



Ocean



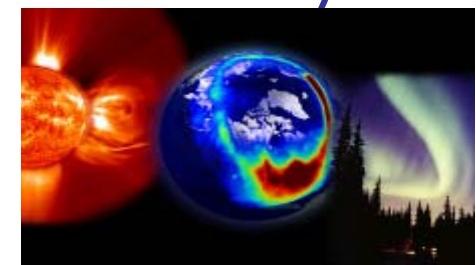
coupled

- Consistent Multi-Domain Environment Representations
- Interactive Search Capability for Relevant Scenarios
- Flexible Delivery Mechanisms



Data Representation & Interchange

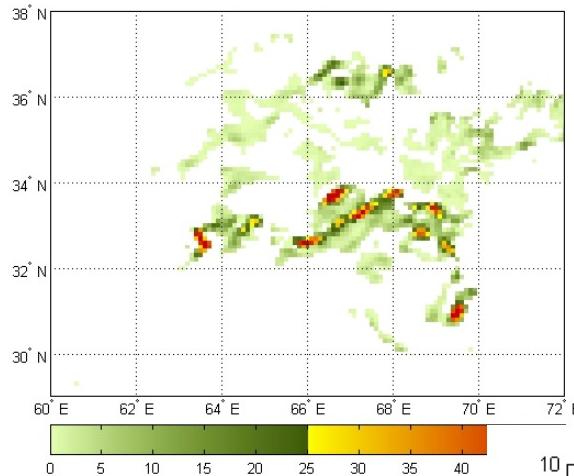
Space



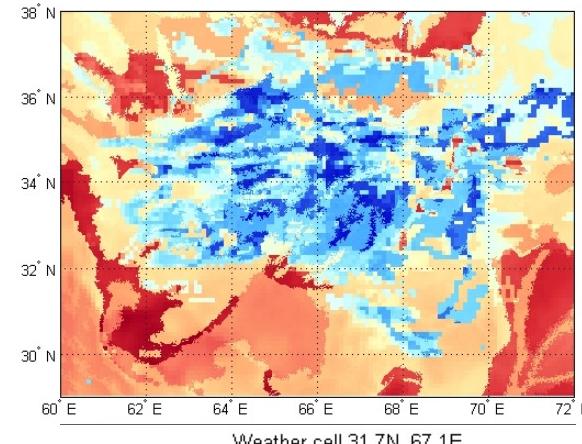


Atmosphere - Terrain Coupling

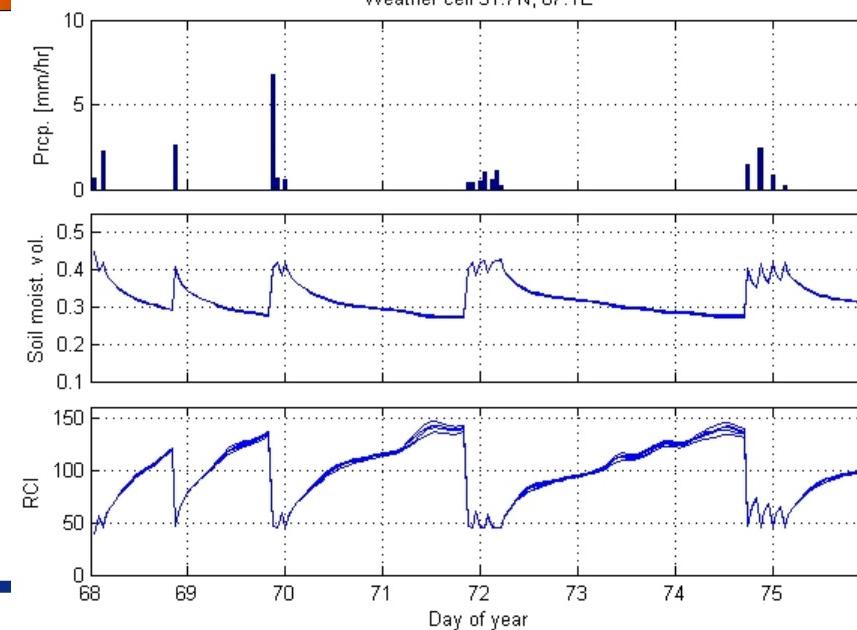
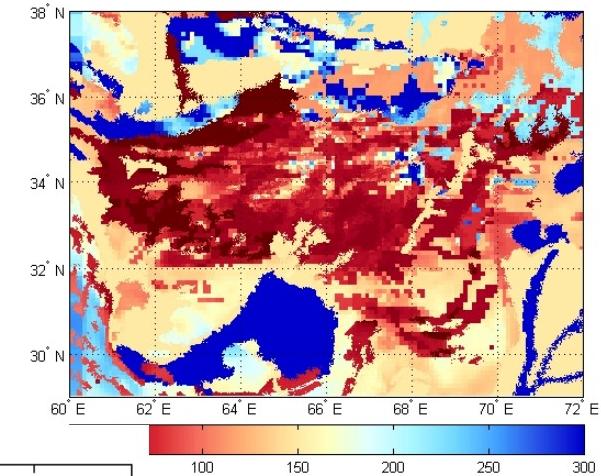
Precipitation Field



Dynamic Soil Moisture

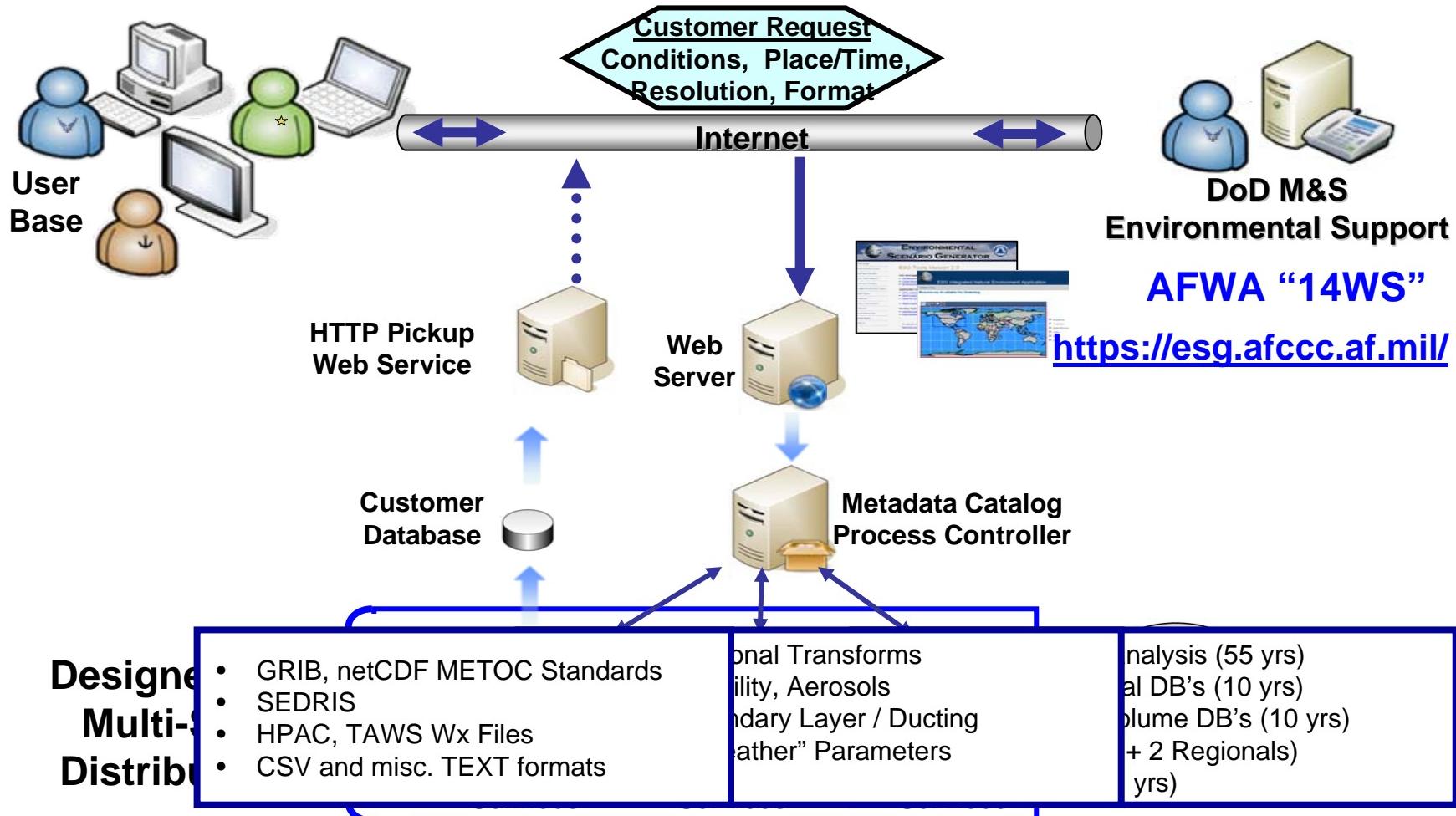


Dynamic Soil Cone Index





ESG Conceptual Architecture



**Designed
Multi-
Source
Distribut**

- GRIB, netCDF METOC Standards
- SEDRIS
- HPAC, TAWS Wx Files
- CSV and misc. TEXT formats

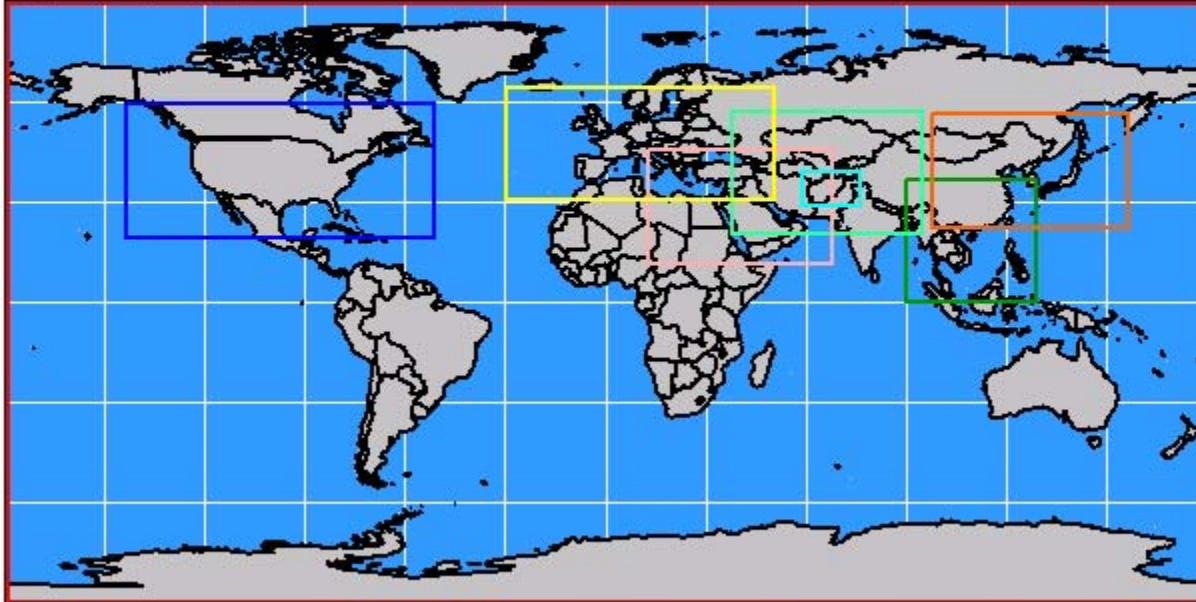
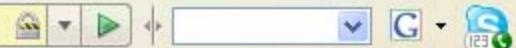
ional Transforms
Wind Velocity,
Aerosols
Boundary Layer / Ducting
"Weather" Parameters

analysis (55 yrs)
Regional DB's (10 yrs)
Global DB's (10 yrs)
+ 2 Regionals)
Regional DB's (10 yrs)

File Edit View History Bookmarks Tools Help



https://esg.afccc.af.mil/atmos/app



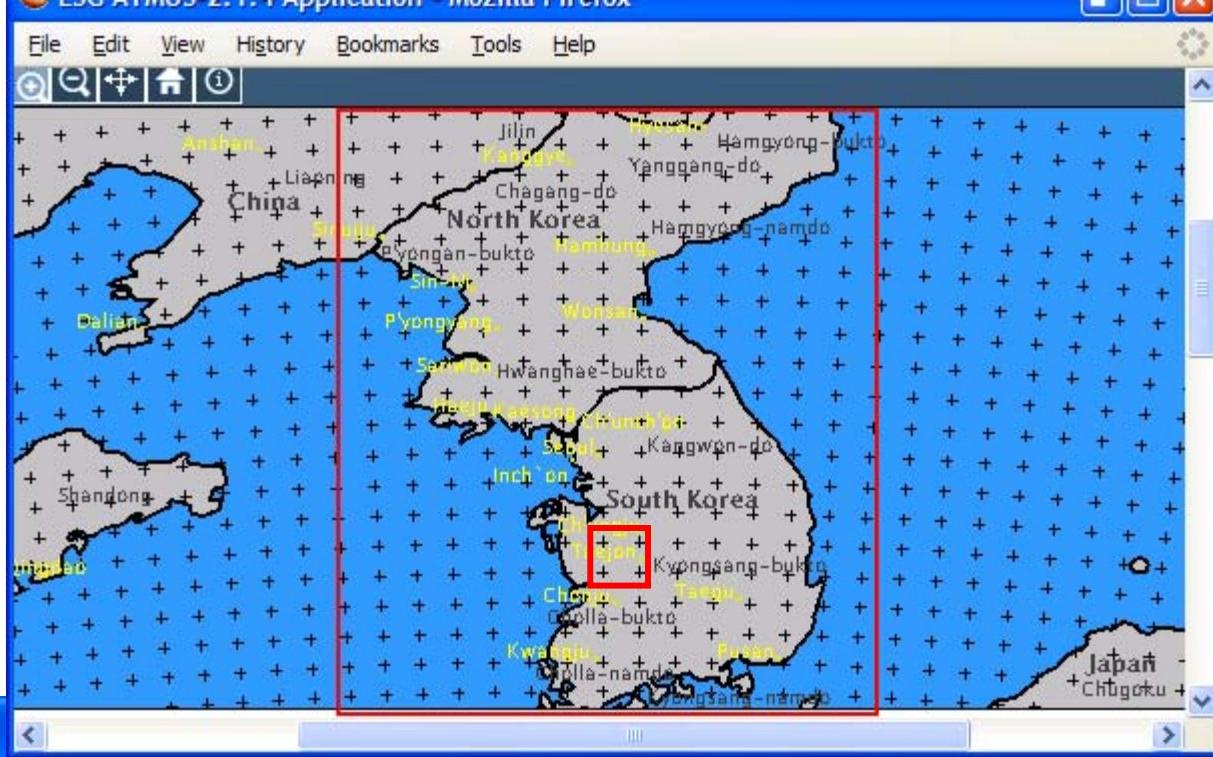
- WorldGrid
- Countries
- States/Provinces
- Cities
- Rivers
- Lakes

Atmosphere Resources

| | | | | | |
|-----------------------|----------------------|---|-------------------------|---------|---------|
| <input type="radio"/> | NCEP/NCAR Reanalysis | ✓ | 01/01/1950 - 06/30/2006 | 6 hours | 2.5 deg |
| <input type="radio"/> | ACMES CASIA | ✓ | 10/01/1986 - 09/30/1996 | 1 hour | 40 km |
| <input type="radio"/> | ACMES IRAQ | ✓ | 10/01/1986 - 09/30/1996 | 1 hour | 40 km |
| <input type="radio"/> | ACMES KOR4 | ✓ | 10/01/1986 - 09/30/1996 | 1 hour | 40 km |
| <input type="radio"/> | ACMES SEAS2 | ✓ | 10/01/1986 - 09/30/1996 | 1 hour | 40 km |
| <input type="radio"/> | ACMES EUROPE | ✓ | 10/01/1986 - 09/30/1996 | 1 hour | 40 km |
| <input type="radio"/> | ACMES Conus3 | ✓ | 10/01/1986 - 09/30/1996 | 1 hour | 40 km |
| <input type="radio"/> | ACMES CASIAB | ✓ | 10/01/1986 - 09/30/1996 | 1 hour | 10 km |

Space Resources

| | | | | | |
|-----------------------|---------------------------------------|---|-------------------------|--------|---------|
| <input type="radio"/> | Space Weather Global Derived Indices | ✓ | 01/01/1991 - 12/31/2002 | 1 hour | 0.0 deg |
| <input type="radio"/> | Space Weather Global Observed Indices | ✓ | 01/01/1991 - 12/31/2002 | 1 hour | 0.0 deg |



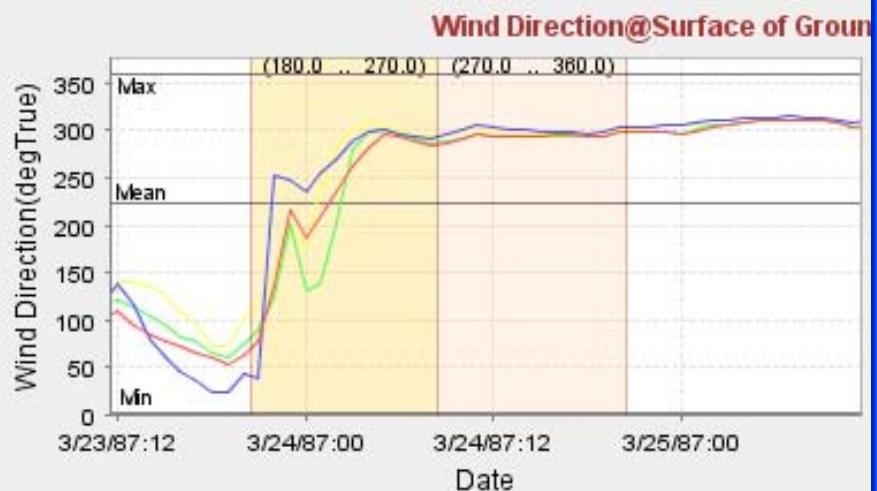
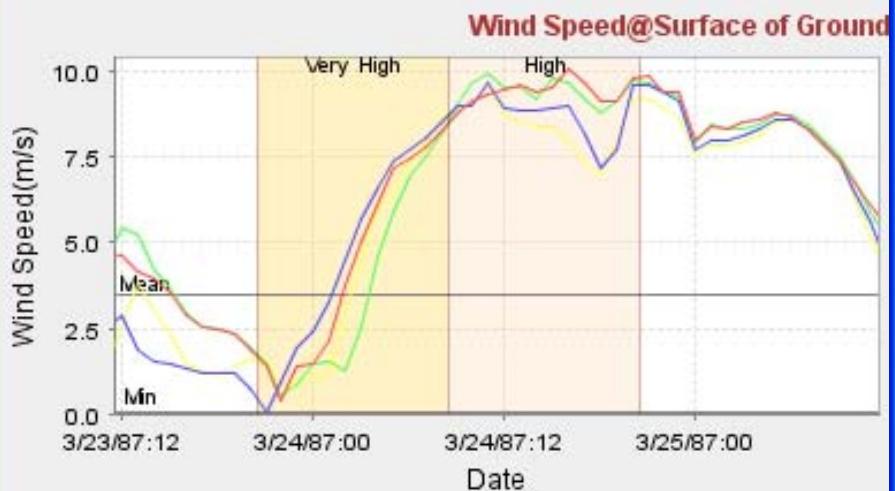
- Mozilla Firefox

Tools Help

| Add Segment | | Delete Segment | | | Delete Segment | | |
|-------------------------------------|----------------|-------------------|-------|----------------|-------------------|-------|--------------------------|
| | | Segment Duration: | | 12 Hour | Segment Duration: | | 12 Hour |
| Criteria | Operator | T1 | T2 | Operator | T1 | T2 | |
| Temperature(F) @ Surface | Very High | 0.0 | 0.0 | Low | 0.0 | 0.0 | <input type="checkbox"/> |
| Total Cloud Cover(%) @ Surface | Any Value | 0.0 | 0.0 | Any Value | 0.0 | 0.0 | <input type="checkbox"/> |
| Wind Direction(degTrue) @ Surface | t1 < Parm < t2 | 180.0 | 270.0 | t1 < Parm < t2 | 270.0 | 360.0 | <input type="checkbox"/> |
| Wind Speed(m/s) @ Surface | Very High | 0.0 | 0.0 | High | 0.0 | 0.0 | <input type="checkbox"/> |

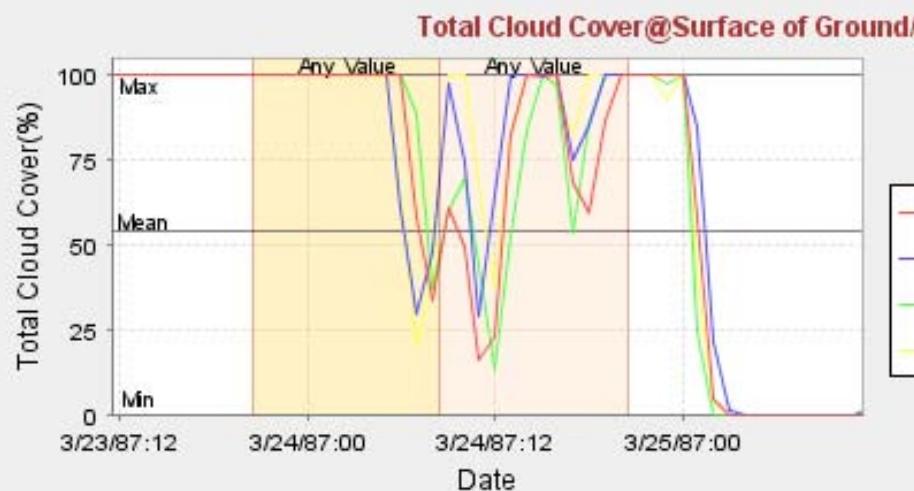
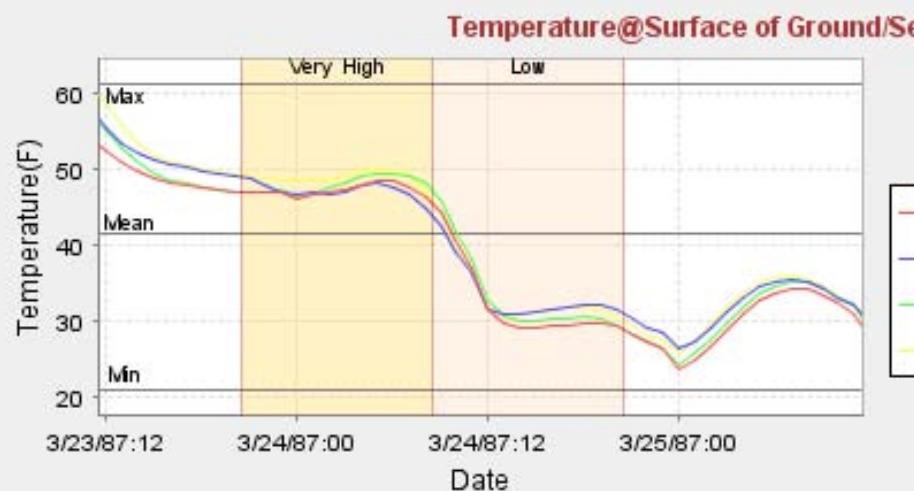
ESG ATMOS-2.1.4 Application - Mozilla Firefox

File Edit View History Bookmarks Tools Help



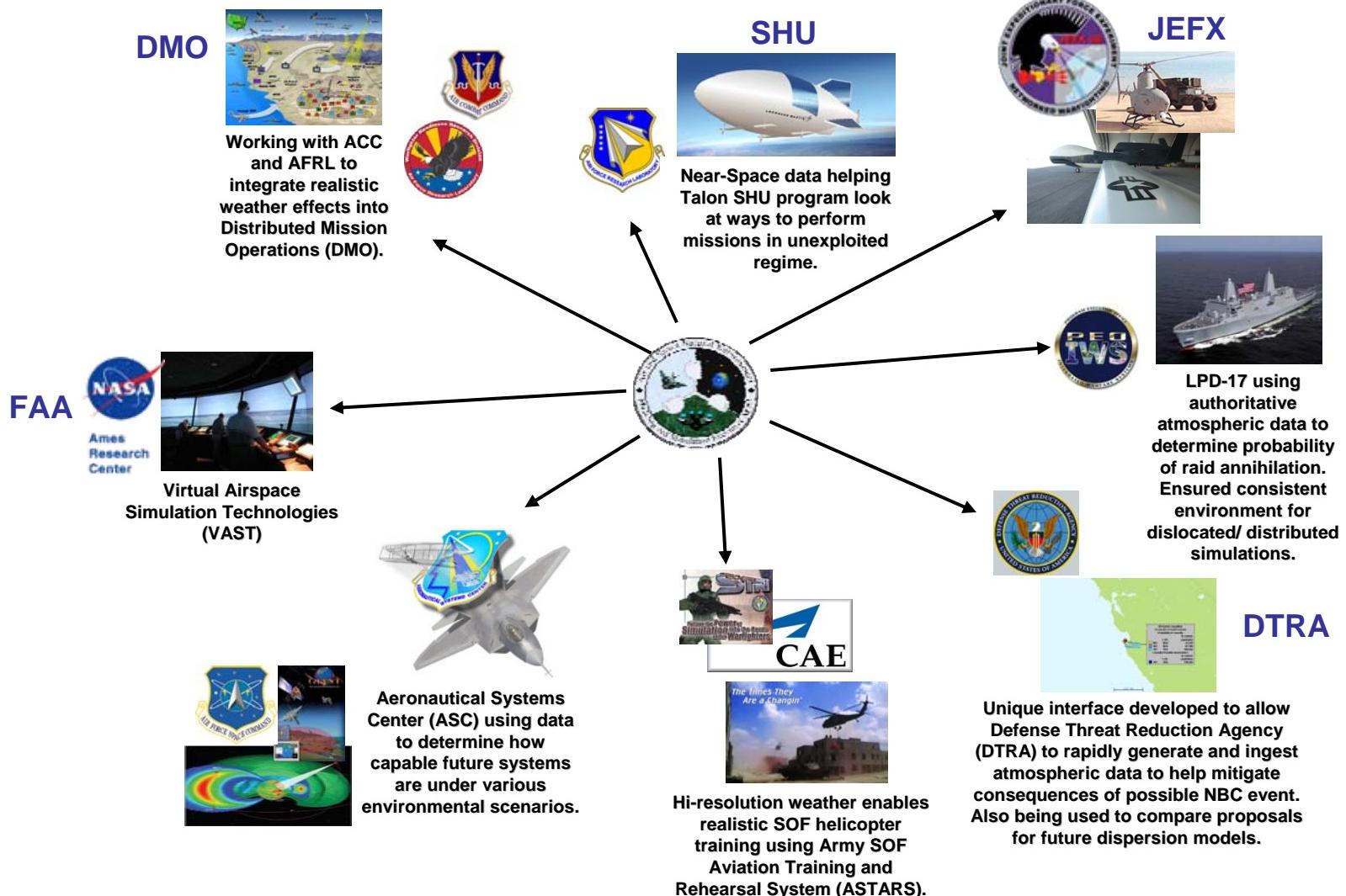
ESG ATMOS-2.1.4 Application - Mozilla Firefox

File Edit View History Bookmarks Tools Help





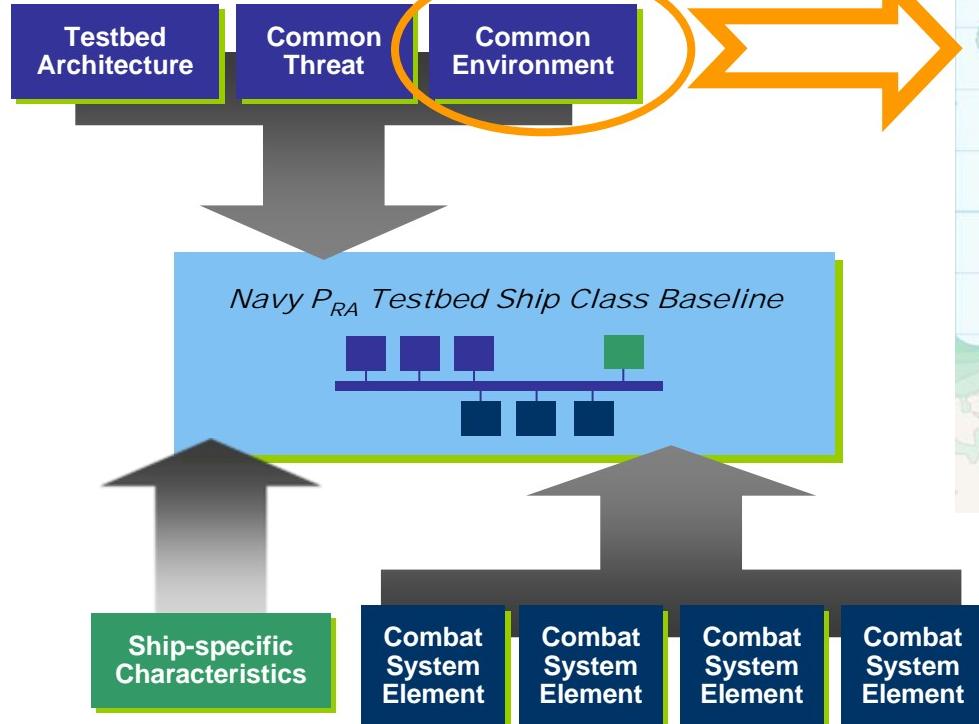
Programs Leveraging the INEARP



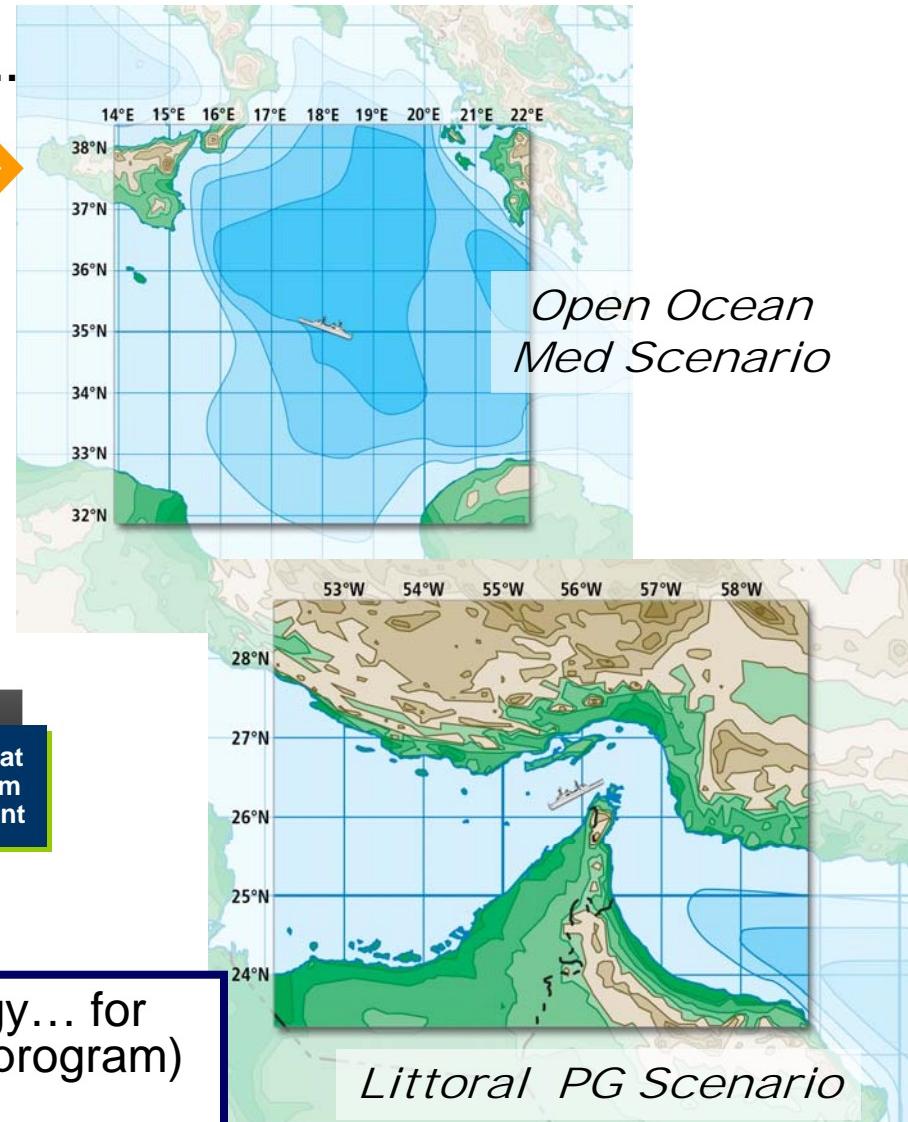


PEO/IWS Enterprise P_{RA} Testbed

“Virtual Range”



RDML Frick: “Thanks to ESG technology... for datasets to meet specified conditions...(program) lifetime cost avoidance \$50M!”





INEARP Program

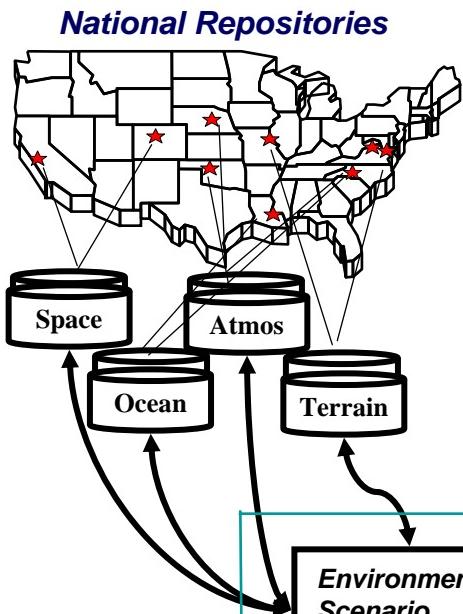
- Three-Year effort (FY-08 is year two) sponsored by the Acquisition community via the M&S Coordination Office
 - Sponsor: Mr. Dipetto
 - Oversight: Mr. Lewis, DoD ASNE MSE
 - Performance: AER, Inc.
- FY-08 Funded Development Initiatives
 - Working with NGDC on remote access to Space resources
 - Integration of higher-res atmospheric data archives (ERA-40) and modeling capabilities (WRF)
 - Standup of SIPRNET site
 - Upgrade of SEDRIS capabilities per FCS requirements
 - Expanded Web Service capabilities

JOINT END-TO-END PROGRAM

"A Factory to Foxhole Process"

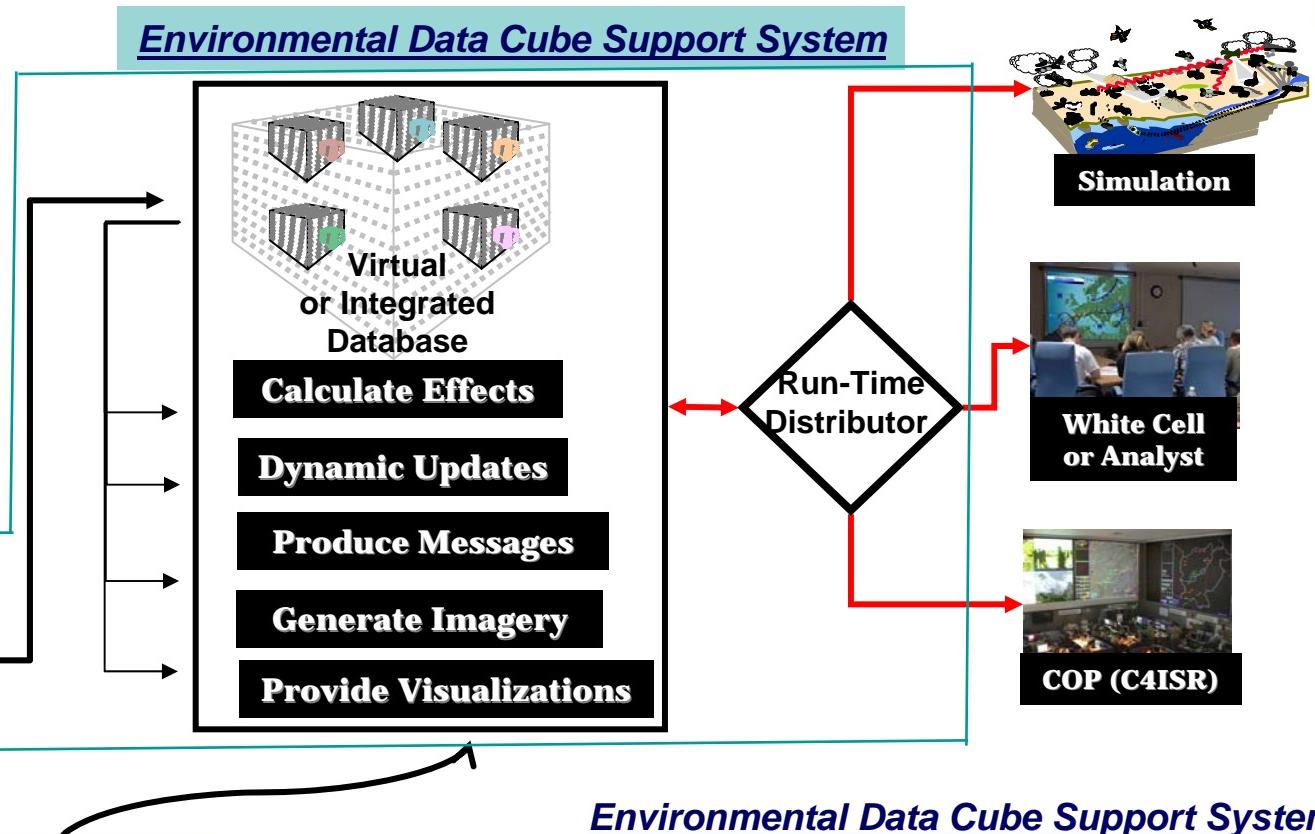
#1

**Build & Tailor
Data**



#2

**Correlate
Products, Effects**



#3

**Distribute
Live, Virtual, Constructive**

- Environmental Data Cube Support System*
- AF, Navy, NGA Led
 - Over-arching Environment Effort
 - Leverage Gov't Environment Data Centers



Summary

- Realistic M&S requires high-fidelity, consistent, and relevant multi-domain environment representations
- The INEARP provides the roadmap. The ESG and SEDRIS are two key enabling technologies
 - National data and modeling assets provide the content
- The ASNE MSEAs are working with the Ocean and Terrain MSEAs to realize the full INEARP vision



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